

north-northeast); normal number for August, 29. Average force of wind (during daylight), Beaufort scale, 3.6. Average cloudiness, in tenths of sky, 4.2; normal, in tenths of sky, 4.0.

Approximate percentages of district rainfall as compared with normal: South Hilo, 160 per cent; North Hilo, 220 per cent; Hamakua, 210 per cent; Kohala, 125 per cent; Waimea (Hawaii), 200 per cent; Kona, 68 per cent; Kau, 40 per cent; Puna, 200 per cent; Maui, 160 per cent; excepting Wailuku, 40 per cent; Oahu, 85 per cent; excepting Kahuku, 200 per cent; Kauai, 145 per cent. The rain on Oahu has been frequent but not of much volume.

Rainfall data for August, 1902.

| Stations. | Elevation. | Amount. | Stations. | Elevation. | Amount. |
|---------------------|------------|---------|------------------------------|------------|---------|
| HAWAII. | | | OAHU. | | |
| Hilo, e. and ne. | Feet. | Inches. | Punahou (W. B.), sw. | 47 | 1.74 |
| Waiakea | 50 | 18.39 | Kulaokahua, sw. | 50 | 1.04 |
| Hilo (town) | 100 | 20.85 | U. S. Naval Station, sw. | 6 | 1.12 |
| Kaunama | 1,250 | 34.78 | Kapiolani Park, sw. | 10 | 0.42 |
| Pepeekeo | 100 | 15.74 | Manoa (Woodlawn Dairy), c. | 285 | 6.64 |
| Hakalau | 200 | 18.40 | School street (Bishop), sw. | 50 | 2.04 |
| Honohina | 300 | 22.41 | Insane Asylum, sw. | 30 | 1.76 |
| Laupahoehoe | 500 | 27.86 | Kalihi-Uka, sw. | 260 | 7.37 |
| Ookala | 400 | 20.11 | Nuuanu (W. W. Hall), sw. | 50 | 1.63 |
| HAMAKUA, ne. | | | Nuuanu (Elec. Station), sw. | 405 | 4.60 |
| Kukaiaua | 250 | 14.66 | Nuuanu (Luakaha), c. | 850 | 9.08 |
| Paauilo | 750 | 11.82 | Waimanalo, ne. | 25 | 1.10 |
| Paauhau (Mill) | 300 | 8.25 | Maunawili, ne. | 300 | 8.01 |
| Honokaa (Muir) | 425 | 9.59 | Ahulimanu, ne. | 850 | 4.72 |
| Kukuihaele | 700 | 11.15 | Kahuku, n. | 25 | 3.54 |
| KOHALA, n. | | | Waihalu, n. | 20 | 0.10 |
| Niuli | 200 | 7.72 | Waihalu, c. | 900 | 1.50 |
| Kohala (Mission) | 521 | 6.80 | Ewa Plantation, s. | 60 | 0.00 |
| Kohala (Sugar Co.) | 235 | 7.10 | Moanalua, sw. | 15 | 0.81 |
| Hawi Mill | 600 | 6.52 | U. S. Magnetic station | 50 | 0.00 |
| Waimea | 2,720 | 6.16 | Rhodes gardens (Manoa) | 300 | 9.68 |
| KONA, w. | | | Experiment Sta., U. S. | 350 | 2.40 |
| Holualoa | 1,350 | 5.18 | Nahuina (Castle) | 1,150 | 7.87 |
| Kealahou | 1,580 | 5.17 | KAUAI. | | |
| Napoopoo | 25 | 2.53 | Lihue (Grove Farm), e. | 200 | 3.29 |
| KAU, se. | | | Lihue (Molokaa), e. | 300 | 4.31 |
| Kahuku Ranch | 1,680 | 3.45 | Lihue (Kukana), e. | 1,000 | 6.96 |
| Honoupo | 15 | 0.98 | Kealia, e. | 15 | 0.77 |
| Naalehu | 650 | 2.28 | Kilauea, ne. | 325 | 6.23 |
| Hilea | 310 | 1.30 | Haualei, n. | 10 | 9.02 |
| Pahala | 850 | 2.14 | Eleele, s. | 200 | 0.82 |
| PUNA, e. | | | Wahiawa Mountain, s. | 2,100 | 14.45 |
| Volcano House | 4,000 | 14.34 | McBryde (Residence) | 850 | 4.39 |
| Olaa, Mountain View | 1,690 | 36.53 | Lawai | 450 | 5.81 |
| Kapoho | 110 | 10.58 | East Lawai | 800 | 5.02 |
| MAUI. | | | West Lawai | 200 | 2.94 |
| Walopae Ranch, s. | 700 | 1.36 | Delayed June reports. | | |
| Kaupo (Mokulau), s. | 285 | 9.08 | Honokaa (Meinicke) | 1.15 | |
| Kipahulu, s. | 300 | 9.52 | Kapoho | 8.64 | |
| Nahiku, ne. | 800 | 20.76 | Hilo (town) | 8.49 | |
| Haiku, n. | 700 | 5.89 | Pahala | 0.49 | |
| Kula (Erehwon), n. | 4,500 | 4.46 | Kahuku, Kau | 3.09 | |
| Kula (Waiahoa), n. | 2,700 | 2.58 | Hawi Mill | 3.70 | |
| Puomalei, n. | 1,400 | 7.80 | Kaunama | 13.80 | |
| Haleakala Ranch, n. | 2,000 | 3.13 | Puuhua | 12.38 | |
| Wailuku, ne. | 200 | 0.40 | | | |

NOTE.—The letters n, s, e, w, and c show the exposure of the station relative to the winds.

Mean temperatures: Pepeekeo, Hilo district, 100 feet elevation, mean maximum, 78.3°; mean minimum, 71.8°; Waimea, Hawaii, 2,780 elevation, 76.8° and 66.0°; Kohala, 521 elevation, 79.3° and 69.1°; Waiahoa, Kula, Maui, 2,700 elevation, 85.3° and 62.4°; Ewa Mill, 50 elevation, 86.1° and 72.0°; United States Magnetic Station, 50 elevation, 89.7° and 71.9°; United States Experiment Station, Jared W. Smith, 350 elevation, 85.2° and 72.1°; W. R. Castle, Honolulu, 50 elevation, highest, 87°; lowest, 71°; mean, 78.6°; Waikiki Beach, 10 elevation, 83.7° and 75.3°.

NOTE.—The mean temperature of a station in Hawaii should be considered as the mean of maximum and minimum, minus 0.7°.

Ewa Mill mean dew point, 67.0°; mean relative humidity, 70.4 per cent; United States Magnetic Station, 65.5 and 65.0 per cent; Kohala, Dr. B. D. Bond, 69.3° dew-point, 84.0 per cent relative humidity.

Earthquakes reported: Pepeekeo, Hilo, 8th, 2.15 p. m., Hilo, 15th, 2.25 p. m.; Hilo, 25th; Papaaloa, 26th, 7 p. m.; 27th, 3 a. m. Lake of molten lava 400 feet in diameter appeared in the bottom of Halemaumau pit in Kilauea crater on the even-

ing of the 25th, said to be 800 or more feet below general floor of crater, but rising.

Afterglows noticed, but not as brilliant as in the previous months.

Electric storms near Honolulu 3d and 4th, 19th and 20th; on Hawaii 6th, 20th, 21st. This number is rare for this month.

Heavy surf noted, Hawaii, 3d, 14th, 21st, 30th; Honolulu, 25th. Strong winds, 12-15th, 28th-31st.

OBSERVATIONS AT HONOLULU.

The station is at 21° 18' N., 157° 50' W. It is the Weather Bureau station Punahou. (See fig. 2, No. 1, in the MONTHLY WEATHER REVIEW for July, 1902, page 365.)

Hawaiian standard time is 10^h 30^m slow of Greenwich time. Honolulu local mean time is 10^h 31^m slow of Greenwich.

Pressure is corrected for temperature and reduced to sea level, and the gravity correction, -0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7.31 p. m., Greenwich time, on the respective dates.

The rain gauge, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet, and the barometer 50 feet above sea level.

Meteorological Observations at Honolulu, August, 1902.

| Date. | Pressure at sea level. | Temperature. | | During twenty-four hours preceding 1 p. m. Greenwich time, or 1:30 a. m. Honolulu time. | | | | | | | | | | Total rainfall at 9 a. m. local time. |
|-----------|------------------------|--------------|-----------|---|----------|------------|--------------------|-----------------------|--------|---------------------|----------------------|----------|------|---------------------------------------|
| | | | | Temperature. | | Means. | | Wind. | | Average cloudiness. | Sea-level pressures. | | | |
| | | Dry bulb. | Wet bulb. | Maximum. | Minimum. | Dew-point. | Relative humidity. | Prevailing direction. | Force. | | Maximum. | Minimum. | | |
| 1 | 29.96 | 75 | 70 | 84 | 69 | 67.7 | 75 | ne. | 3 | 4 | 30.00 | 29.93 | 0.00 | |
| 2 | 29.97 | 77 | 70.5 | 85 | 75 | 68.3 | 71 | ne. | 3 | 2 | 30.01 | 29.94 | 0.01 | |
| 3 | 29.98 | 76 | 70.5 | 85 | 76 | 67.3 | 68 | ne. | 4 | 4 | 30.03 | 29.97 | 0.02 | |
| 4 | 29.89 | 77 | 72 | 83 | 74 | 69.7 | 76 | ne. | 4 | 5-2 | 30.01 | 29.89 | 0.05 | |
| 5 | 29.82 | 74 | 72.7 | 83 | 75 | 70.0 | 79 | se-s. | 1 | 10 | 29.95 | 29.86 | 0.37 | |
| 6 | 29.96 | 74 | 73 | 84 | 72 | 71.0 | 81 | ne. | 1 | 10-4 | 30.02 | 29.93 | 0.08 | |
| 7 | 29.99 | 77 | 70.5 | 86 | 78 | 70.0 | 76 | ne. | 3 | 3 | 30.03 | 29.95 | 0.00 | |
| 8 | 29.98 | 75 | 69 | 85 | 75 | 67.7 | 68 | ne. | 3 | 3 | 30.02 | 29.95 | 0.01 | |
| 9 | 29.93 | 74 | 68 | 84 | 74 | 66.0 | 67 | ne. | 3 | 1 | 29.98 | 29.90 | 0.02 | |
| 10 | 29.93 | 74 | 69 | 82 | 74 | 64.7 | 67 | ne. | 3-1 | 6-2 | 29.98 | 29.91 | 0.01 | |
| 11 | 29.96 | 76 | 70 | 83 | 72 | 66.7 | 74 | nne. | 3-4 | 5 | 30.00 | 29.93 | 0.04 | |
| 12 | 30.00 | 78 | 72 | 85 | 73 | 67.3 | 68 | ne. | 3-4 | 2 | 30.05 | 29.95 | 0.03 | |
| 13 | 29.99 | 76 | 71 | 85 | 75 | 69.0 | 72 | ne. | 4-5 | 7-3 | 30.04 | 29.96 | 0.06 | |
| 14 | 29.96 | 77 | 71.5 | 79 | 74 | 71.5 | 83 | ne. | 4-5 | 8 | 30.02 | 29.94 | 0.26 | |
| 15 | 29.99 | 76 | 67.5 | 83 | 76 | 68.0 | 70 | ne. | 4-5 | 8-4 | 30.04 | 29.96 | 0.01 | |
| 16 | 29.99 | 76 | 69 | 84 | 76 | 64.0 | 63 | nne. | 6-4 | 3 | 30.05 | 29.96 | 0.00 | |
| 17 | 29.97 | 76 | 69 | 83 | 75 | 65.0 | 65 | ne. | 4 | 4 | 30.06 | 29.97 | 0.06 | |
| 18 | 29.96 | 75 | 70 | 83 | 72 | 66.5 | 68 | ne. | 4 | 4 | 30.00 | 29.93 | 0.07 | |
| 19 | 29.96 | 76 | 70 | 83 | 74 | 68.5 | 77 | ne. | 3 | 7 | 29.99 | 29.92 | 0.27 | |
| 20 | 29.97 | 75 | 71 | 84 | 72 | 67.5 | 71 | ne. | 3-4 | 5 | 30.01 | 29.94 | 0.16 | |
| 21 | 29.95 | 77 | 71 | 83 | 73 | 68.0 | 73 | ne. | 3-5 | 4 | 30.01 | 29.93 | 0.03 | |
| 22 | 29.94 | 76 | 71 | 84 | 75 | 68.3 | 72 | ene. | 3-4 | 5 | 29.99 | 29.92 | 0.08 | |
| 23 | 29.93 | 76 | 70 | 84 | 73 | 67.7 | 70 | ne. | 3-2 | 2-4 | 29.98 | 29.91 | 0.00 | |
| 24 | 29.92 | 77 | 70 | 85 | 75 | 66.7 | 68 | ne. | 3 | 2-4 | 29.96 | 29.91 | 0.01 | |
| 25 | 29.94 | 76 | 70.5 | 85 | 75 | 67.5 | 70 | ne. | 3-4 | 4-2 | 29.99 | 29.90 | 0.06 | |
| 26 | 29.94 | 76 | 69.5 | 84 | 73 | 66.7 | 69 | ne. | 3-4 | 4 | 29.98 | 29.91 | 0.00 | |
| 27 | 29.94 | 77 | 69.5 | 84 | 75 | 66.7 | 67 | ne. | 3-4 | 2 | 29.98 | 29.90 | 0.01 | |
| 28 | 29.98 | 76 | 69 | 84 | 74 | 66.0 | 67 | nne. | 4-3 | 4 | 30.01 | 29.94 | 0.05 | |
| 29 | 30.00 | 77 | 69 | 84 | 75 | 65.7 | 65 | ne. | 4 | 4 | 30.04 | 29.96 | 0.00 | |
| 30 | 30.03 | 77 | 68.5 | 84 | 76 | 65.0 | 64 | ne. | 4-5 | 3 | 30.09 | 30.01 | 0.01 | |
| 31 | 29.98 | 77 | 69 | 83 | 76 | 64.5 | 63 | ne. | 4-5 | 5 | 30.06 | 29.97 | 0.06 | |
| Sums | | | | | | | | | | | | | | 1.74 |
| Means | 29.962 | 76.0 | 70.1 | 83.7 | 74.2 | 67.3 | 70.5 | | 3-6 | 4.2 | 30.012 | 29.937 | | |
| Departure | -0.008 | | | | | +1.3 | +2.0 | | | | +0.2 | | | -0.24 |

Mean temperature for August, 1902, (6+2+9+3)=78.5; normal is 77.7. Mean pressure for August, 1902, (9+3+2)=29.971; normal is 29.979.

* This pressure is as recorded at 1 p. m., Greenwich time. † These temperatures are observed at 6 a. m., local, or 4.31 p. m., Greenwich time. ‡ These values are the means of (6+9+2+9)÷4. § Beaufort scale.

TEXT-BOOKS AND WORKS OF REFERENCE FOR STUDENTS OF ELEMENTARY METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

Many inquiries regarding text-books and reference works suited to the wants of teachers and students of elementary meteorology have come to the Weather Bureau as incidental to the increasing attention paid to meteorology in the public schools and in many of the higher educational institutions. From time to time the writer has noted the titles of the works he has had occasion to suggest as answering some one or more of the various purposes and wants of the different inquirers.

As a result a number of titles have been brought together, which, with the addition of some others that occur as being of use in one or another way to teachers and students, constitute the appended list. Most of the titles named are those of works dealing with the general subject of meteorology, but whoever consults any one or more of them, especially those of recent issue, will find references to other works, not named in the list, which may be profitably consulted. References will also be found to papers and other publications dealing with the special problems of meteorology. In fact it is believed that this list will be found a sufficient ground, work or base of reference, for those desiring to prosecute more thoroughly the interesting study of meteorology. To those who desire the most elementary knowledge or wish to begin with the simplest recitals, the works of Archibald, Abercromby, Dickson, Chambers, Giberne, Harrington, Moore, and Scott are suggested. For intermediate use, the works of Davis, Russell, and Waldo, and for more advanced purposes the publications of Brillouin, Abbe, Ferrel, Bigelow, and Hann are recommended.

Abbe, Cleveland. Short Memoirs on Meteorological Subjects. Appendix to the Annual Report of the Smithsonian Institution for 1877, pp. 376-478. 8vo. Washington, 1878.

Abbe, Cleveland. Mechanics of the Earth's Atmosphere. (Smithsonian Miscellaneous Collections No. 843.) 324 pp. 8vo. Washington, 1891.

Abbe, Cleveland. Meteorological Apparatus and Methods. (Forming Part 2 of the Annual Report of the Chief Signal Officer for 1887.) 388 pp. 8vo. Washington, 1887.

Abercromby, Ralph. Weather: A popular exposition of the nature of weather changes from day to day. 491 pp. 12mo. London, 1887.

Allingham, William. Manual of Marine Meteorology. 195 pp. 12mo. London, 1900.

Angot, A. Traité élémentaire de météorologie. 423 pp. 4to. Paris, 1899.

Arago François. Meteorological Essays. 540 pp. 8vo. London, 1855.

Archibald, Douglas. Story of the Earth's Atmosphere. 194 pp. 16mo. New York, 1897.

Assmann, Richard and Berson, Arthur. Wissenschaftliche Luftfahrten. 3 Vol. 162 pp., 717 pp., 313 pp. 4to. Braunschweig, 1899-1900.

Bartholomew, J. G. and Herbertson, A. J. Atlas of Meteorology. Edited by Alexander Buchan. (Bartholomew's Physical Atlas, Vol. III.) 54 pp. 34 pl. 12 by 18 inches. (Comprising about 400 charts.) London, 1899.

Bebber, W. J. van. Hygienische Meteorologie. 340 pp. 8vo. Stuttgart, 1895.

Bebber, W. J. van. Lehrbuch der Meteorologie. 403 pp. 8vo. Stuttgart, 1890.

Bigelow, Frank Hagar. Storms, Storm-tracks, and Weather Forecasting. United States Weather Bureau Bulletin No. 20. 87 pp. 8vo. Washington, 1897.

Bigelow, Frank Hagar. Report on the International Cloud Observations. May 1, 1896, to July 1, 1897. 787 pp. 4to. Washington, 1900. (Forming Vol. 2 of the Report of the Chief of the Weather Bureau. 1898-1899.)

Blanford, H. F. Indian Meteorologists Vade Mecum. Calcutta, 1877. 266 pp.

Blanford, H. F. A Practical Guide to the Climates and Weather of India, Ceylon, and Burmah and the Storms of the Indian Sea. 382 pp. 8vo. London, 1889.

Blodget, L. Climatology of the United States. 536 pp. 4to. Philadelphia, 1857.

Börnstein, R. Leitfaden der Wetterkunde. 189 pp. 8vo. 1901.

Brillouin, Marcel. Mémoires originaux sur la circulation générale de l'atmosphère. 20, 163 pp. 8vo. Paris, 1900.

Buchan, Alexander. Handy Book of Meteorology. 383 pp. 12mo. London, 1868.

Buchan, Alexander. Report on atmospheric circulation. "Challenger Reports." Vol. II. 744 pp. 1889. 4to.

Chambers, George F. Story of the Weather. 232 pp. 24mo. London, 1897.

Coffin, J. H. Winds of the Globe, or the Laws of Atmospheric Circulation over the Surface of the Earth. 768 pp. 4to. Washington, 1876.

Davis, William Morris. Elementary meteorology. 367 pp. 8vo. Boston, 1898.

Deutsche Seewarte. Segelhandbuch für den Stillen Ozean. 928 pp. 4to. Hamburg, 1897.

Dickson, H. N. Meteorology. The elements of weather and climate. 192 pp. 12mo. London, 1893.

Dove, Heinrich Wilhelm. Law of Storms. 331 pp. 8vo. London, 1862.

Dunwoody, H. H. O. Summary of International Meteorological Observations. United States Weather Bureau Bulletin A. 10 pp. 59 charts. 18 by 24 inches. Washington, 1893.

Encyclopaedia Britannica. (9th edition.) Articles on Climate by Alexander Buchan and Meteorology by Alexander Buchan and Balfour Stewart. (See also the additions known as the 10th Edition, 1902.)

Espy, James. The Philosophy of Storms. 592 pp. 8 vo. Boston, 1841.

Espy, James. First Report on Meteorology to the Surgeon General of the United States Army. 4 pp. 4to. 1843; also 2d and 4th reports 1850, 1857.

Ferrel, William. A Popular Treatise on Winds: Comprising the general motions of the atmosphere, monsoons, cyclones, tornadoes, waterspouts, hailstorms, etc. 420 pp. 8vo. New York, 1889.

Ferrel, William. Recent Advances in Meteorology, systematically arranged in the form of a text-book. (Forming Part 2 of the Annual Report of the Chief Signal Officer for 1885.) 440 pp. 8vo. Washington, 1886.

Findlay, Alexander George. Directory for the Navigation of the North Pacific Ocean. 1346 pp. 8vo. London, 1886.

Findlay, Alexander George. Memoir, descriptive and explanatory of the Northern Atlantic Ocean. 892 pp. 8vo. London, 1879.

Findlay, Alexander George. Text-book of Ocean Meteorology. 259 pp. 8vo. London, 1887.

Flammarion, Camille. L'Atmosphère, Météorologie populaire. 808 pp. 4to. Paris, 1888.

— Translated into English by J. Glaisher. 453 pp. 8vo. 1873.

Greely, Adolphus Washington. American Weather. A popular exposition of the phenomena of the weather, including chapters on hot and cold waves, blizzards, hailstorms, and tornadoes. 298 pp. 8vo. 1888.

Giberne, Agnes. Ocean of Air. Meteorology for beginners. 352 pp. 12mo. London, 1891.

Hann, J. Handbuch der Klimatologie. 2d Edition. 3 Vols. 8vo. Stuttgart, 1897.

— English translation by R. DeC. Ward. (In Press.)

Hann, J. Atlas der Meteorologie. (Berghaus' Physikalischer Atlas Abtheilung III.) 12 pp. 12 plates. 8 by 13 inches. Gotha, 1887.

Hann, J. Lehrbuch der Meteorologie. 819 pp. 8vo. Leipzig, 1901.

Harrington, Mark W. About the Weather. 262 pp. 12mo. New York, 1899.

Henry, Alfred Judson. Rainfall of the United States. United States Weather Bureau Bulletin D. 58 pp. 4to. Washington, 1897.

Henry, Joseph. Papers on meteorology, in Vol. 2 of his Scientific Writings. Smithsonian Miscellaneous Collections. Vol. 30. 559 pp. 8vo. Washington, 1886.

Herbertson, Andrew John. Distribution of Rainfall over the Land. 70 pp. 8vo. London, 1901.

Houdaille, F. Météorologie agricole. 204 pp. 12mo. Paris. Not dated.

Johnson's New Universal Cyclopaedia, Article on Meteorology by Cleveland Abbe. 1878.

Johnson's Universal Cyclopaedia, Articles on Climate and Meteorology by M. W. Harrington. 1892.

Kämtz, Ludwig Friedrich. Lehrbuch der Meteorologie. 3 Vols. 526 pp., 615 pp., 563 pp. 8vo. Leipzig, 1831. Halle, 1832-36.

— Vorlesungen über Meteorologie. 8vo. Halle, 1840.

— Cours complet de météorologie, traduit et annoté par Ch. Martins. Paris, 1843.

— Complete Course of Meteorology. Translated by C. V. Walker. 630 pp. London, 1845.

Kastner, K. W. G. Handbuch der Meteorologie. 3 Vols. 502 pp., 655 pp., 638 pp. Erlangen. 8vo. 1823-1830.

Loomis, Elias. Treatise on Meteorology. 313 pp. 8vo. New York. First edition 1870, last edition 1883.

Mann, Robert James, Laughton, John Knox, Strachan, Richard, Ley, W. Clement, Symons, George James, Scott, Robert H. Modern Meteorology. Six lectures under the auspices of the Meteorological Society in 1878.

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Mohn, H. Grundzüge der Meteorologie. 5th Edition. 431 pp. 8vo. 1898.

Moore, John William. Meteorology, Practical and Applied. 466 pp. 12mo. London, 1891.

Paulsen, Adam. Nautisk Meteorologi til brug for Navigations-skoler. 112 pp. 8vo. 1899.

- Piddington, Henry.** The Sailor's Horn-Book for the Law of Storms. 6th edition. 1876.
- Pinke, F.** Leerboek der Maritieme Meteorologie en Oceanografie.
- Plumondon, J. R.** Les poussières atmosphériques. Leur circulation dans l'atmosphère et leur influence sur la santé. 130 pp. 16mo. Paris. Not dated.
- 176 pp. 8vo. Helder 1897.
- Ramsey, William.** Gases of the atmosphere. 240 pp. 8vo. London. 1896.
- Reid, William.** Attempt to develop the Law of Storms. 538 pp. 8vo. London. 1850.
- Report of the International Meteorological Congress held at Chicago, 1893.** Parts I-III. 793 pp. 8vo. Washington. 1894.
- Roster, Giorgio.** Ariä atmosferica. 555 pp. 12mo. Milano. 1889.
- Russell, Thomas.** Meteorology. 290 pp. 8vo. New York. 1895.
- Russia.** Central Physical Observatory. Atlas climatologique de l'Empire de Russie. 89 ch. 15 by 20 inches. St. Petersburg. 1900.
- Schmid, Ernst Erhard.** Lehrbuch der Meteorologie. With atlas. 1025 pp. 8vo. Leipzig. 1860. Atlas, 21 charts. Leipzig. 1860.
- Scholtz, Wm. O.** South African Climate. 200 pp. 8vo. London. 1897.
- Scott, Robert H.** Elementary Meteorology. 4th edition. 424 pp. 12mo. 1887.
- Scott, Robert H.** Weather Charts and Storm Warnings. 3d edition. 235 pp. 12mo. London. 1887.
- Silvado, Americo Brazilio.** Instrucoes meteorologicas. 298 pp. 4to. Rio de Janeiro. 1900.

- Solly, S. Edwin.** Handbook of Medical Climatology. 479 pp. 8vo. Philadelphia. 1897.
- Supan, Alexander.** Verteilung des Niederschlags auf der festen Erdoberfläche. 107 pp. 4to. Gotha. 1898.
- Trabert, Wilhelm.** Meteorologie. 150 pp. 24mo. Leipzig. 1896.
- Voeikov, Aleksandr Ivanovich.** Klimate der Erde. 2 parts. 396 pp., 445 pp. 8vo. Jena. 1887.
- Waldo, Frank.** Elementary Meteorology. 373 pp. 12mo. New York. 1896.
- Waldo, Frank.** Modern Meteorology. 383 pp. 8vo. New York. 1893.
- Ward, Robert DeCourcy.** Practical Exercises in Elementary Meteorology. 212 pp. 8vo. Boston. 1899.
- Weber, F. Parkes, and Hinsdale, Guy.** Climatology, Health Resorts, and Mineral Springs. Vols. 3 and 4 of System of Physiologic Therapeutics. S. Solis-Cohen, Editor. Philadelphia. 1901.

SOME RECENT WORKS ON PHYSICAL GEOGRAPHY, IN WHICH WILL BE FOUND MUCH RELATING TO METEOROLOGY AND CLIMATE.

- Davis, W. M.** Physical Geography. 446 pp. 12mo. Boston. 1899.
- Hughes, William.** A Class-Book of Physical and Astronomical Geography. 332 pp. 12mo. London. 1899.
- Mill, Hugh Robert.** The Realm of Nature, an outline of Physiography. 379 pp. 12mo. New York. 1894.
- Tarr, Ralph S.** Elementary Physical Geography. 509 pp. 12mo. New York. 1897.

NOTES AND EXTRACTS.

EXPERIMENTAL AGRICULTURE AT METEOROLOGICAL STATIONS.

According to the Experiment Station Record, Vol. XIII, No. 8, page 708, the system of agricultural meteorological stations in Russia is especially worthy of commendation. In 1897 the Russian Department of Agriculture and Imperial Domain established a system of stations for the purpose of bringing observations on meteorology and agricultural phenomena into closer relationship, with a view to determining more definitely the effect of various meteorological conditions on crop production:

Each meteorological station has connected with it a series of plats, not exceeding 1 dectaine (2.7 acres) each in area, on which various crops are grown. Adjacent to the plats are arranged the meteorological apparatus for measuring the temperature and humidity of the air, intensity of the sunlight, direction and velocity of the wind, etc. On the plats are installed a rain gage, thermometers for determining the temperature of the soil at the surface and at different depths, and likewise apparatus for determining the humidity of the soil and measuring the snowfall. Phenological observations are made systematically on the crops under cultivation, and a record is kept of the different stages in the development of the plant, of all the work done on the plats, any injuries caused by meteorological or other factors, and the final yields of grain and straw. In addition to these observations some stations study the underground waters, the intensity of the sun's energy, the relations of the atmospheric conditions to cultivation of the soil, and similar matters.

The stations differ in their equipment; those of the second class have only the more common apparatus, and their studies are therefore of a more limited character.

The agricultural meteorological stations are for the most part connected with the experiment stations, experimental fields, and agricultural schools, although some are located on private estates. In addition to the stations there are a large number of "observation plats," which are provided with simpler meteorological apparatus, some having, also, apparatus for the determination of soil moisture.

Early in 1901, when the official report was prepared, there were 65 of these agricultural-meteorological stations, 21 of which were of the first class and 44 of the second class, and 113 observation plats, 90 of which were provided with apparatus for studying soil moisture in addition to the atmospheric conditions. The meteorological bureau, in addition to its work in agricultural meteorology, is elaborating plans for weather forecasting, although little has been done in that direction as yet.

The list of publications of the Meteorological Bureau of the Russian Department of Agriculture includes papers on the practical importance of agricultural meteorology, instructions for making the simplest agricultural-meteorological observations, an article on the relation of the cereal crop to sun spots and meteorological factors, and a review of the observations of the agricultural-meteorological stations of central Russia, together with a number of more popular publications on the relation of meteorological conditions to crop production.

This is evidently the most extensive and systematic series of institu-

tions for the study of agricultural meteorology that has been inaugurated by any country, and its work will be followed with much interest. If nothing more is done than to work out satisfactory methods and a basis for correlating the meteorological and soil conditions with the production of staple crops, the results will be of widespread importance, and will pave the way for similar studies by the experiment stations in various countries.

MOUNTAIN STATIONS FOR METEOROLOGY.

The observatory on the summit of Ben Nevis and the corresponding low-level observatory at Fort William were established in 1883 at a time when the importance of obtaining systematic records of what is called the free atmosphere, at a considerable elevation above sea level was felt as one of the most pressing needs of meteorology. Since those days the employment of the kite and the sounding balloon has enabled us to attain still greater elevations than were considered possible at that time. But these two great improvements must always be very much restricted in their application to meteorology, they can not give us continuous records. The latter are still needed and will in fact continue to be necessary for generations to come, and their records can only be properly interpreted and utilized when combined with the occasional records that are obtained by the use of the kite and balloon and by the study of the upper clouds.

Meteorology considered as a system of research into the laws of the motions of the atmosphere is not a matter that can be prosecuted successfully by any short-lived spasmodic or discontinuous system of work, it must be undertaken by permanent cooperation and the long-continued labors of all nations; the important mountain observatories should especially be maintained intact from generation to generation without any thought of discontinuing their work. Each pair of high and low stations is really of more importance to meteorology than any dozen stations at sea level. The time will doubtless come when Mount Washington, Pikes Peak, and numerous other high stations in this country will be permanently occupied. The reports from both of these stations were frequently of great use to the Editor in his early forecast work, and it is only a question of time when we shall learn how to make use of them on every occasion. Meanwhile we quote the following remarks by Sir Arthur Mitchell, Honorary Secretary of the Scottish Meteorological Society with reference to the Ben Nevis Observatory:

In the work of the two Ben Nevis observatories, the directors did all